

HIGH-RESOLUTION SEISMIC SURVEYING FOR PLEISTOCENE SEQUENCE STRATIGRAPHY, NEW JERSEY CONTINENTAL SHELF AND SLOPE, IN SUPPORT OF STRATAFORM

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LONG-TERM GOALS

The collection (in 1995) and ongoing analysis of high-resolution multichannel seismic (MCS) data on the New Jersey shelf/upper slope is part of STRATAFORM, and specifically supports Ocean Drilling Program (ODP) Leg 174A. The overall goal is to link sedimentation processes to preserved sequence stratigraphy and facies architecture.

SCIENTIFIC OBJECTIVES

Leg 174 A was designed to "ground-truth" STRATAFORM nested seismic data (Figure 1) by studying sea level history during the "Icehouse" (i.e., last ~35 Ma), in conjunction with Leg 150 on the upper slope (Mountain et al., 1994) and Coastal Plain drilling (Legs 150X/174AX; Miller et al., 1994). Analysis of Leg 174A samples and the MCS profiles will: 1) determine the physical nature of shelf stratal surfaces and constrain their acoustic characteristics; 2) tie well-dated Leg 150 sequences to Coastal Plain sections; and 3) link STRATAFORM program elements within the New Jersey "natural laboratory."

APPROACH

Regional profiles, and "hazards" grids across proposed ODP shelf drillsites, supplemented existing data (Figure 1): 1) cores/logs collected in shelf/slope boreholes, most recently by Leg 150; 2) Coastal Plain cores/logs; 3) lower frequency, less densely spaced L-DEO MCS; 4) UTIG Huntec grids and vibra-cores; and 5) commercial MCS coverage.

Austin, Mountain and Buhl collected and are processing/interpreting the MCS profiles. Austin, Fulthorpe, and Mountain participated on Leg 174A; Austin served as Co-Chief Scientist. Miller is coordinating the Coastal Plain drilling and analysis.

WORK COMPLETED

As Leg 174A was the first shelf operation in scientific ocean drilling history, emphasis prior to drilling was placed on the "hazards" grids to satisfy ODP safety requirements: 1) all grids were interpreted for hydrocarbons; 2) safety review approved two locations for drilling; and 3) at both locations, a sequence stratigraphic interpretation was completed.

During summer 1997, Leg 174A drilled at the two approved shelf sites (Sites 1071 and 1072); Site 1073 was located on the upper continental slope regional MCS grid (Figure 1). The preliminary drilling report is now available (Austin et al., 1997). Processing of the regional grid continues; interpretation of that grid is the highest post-Leg 174A priority.

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RESULTS

Leg 174A recovered ~1 km of core, ranging in age from late Eocene-Pleistocene. The shelf succession consists of at least four late middle Miocene to Pleistocene, unconformity-bounded, progradational sequences. Offlap defines sequence boundaries. Shipboard ages (in Ma) of the four unconformities, plus one other surface, are <0.78, 1.1-7.4, 5.9-7.4; 7.4-11.2, and >11.4->12.5 (Figure 2).

The unconformities may represent times/intervals of falling sea level, with seismically unresolved higher-order cyclicity probably present. Between surfaces, the shallow shelf is dominated by sediments that accumulated during flooding. Seaward of breakpoints (positions at which sequence boundaries steepen into clinoforms), the deeper shelf is dominated by sediments that accumulated during progradation. The overall succession consists of sands, silts and clays, with most recovery from muddy intervals; the presence of sands in poorly recovered or unrecovered intervals has been inferred from logs.

IMPACT/APPLICATIONS

Leg 174A, along with Legs 150 and 150X/174AX, constitutes the Mid-Atlantic Sea Level Transect. Understanding the effects of eustasy, among other forcing factors, on the deposition and preservation of stratigraphy is the goal of STRATAFORM. For example, Leg 174A results suggest that while clinoform breakpoints may not have been exposed during their formation, water depths may have been very shallow. Furthermore, unconsolidated sands were more common than expected, suggesting a dominance of transgressive facies in this shelf's sequence development.

TRANSITIONS

The 1995 MCS profiles will be central to most post-Leg 174A investigations.

RELATED PROJECTS

Leg 174A attempted to sample Miocene clinoforms mapped by Fulthorpe (Fulthorpe and Austin, in press). Huntex studies in the Leg 174A area are being conducted by Austin (e.g., Austin et al., 1996) and a post-grads Ph.D. student at UTIG, L. Schuur.

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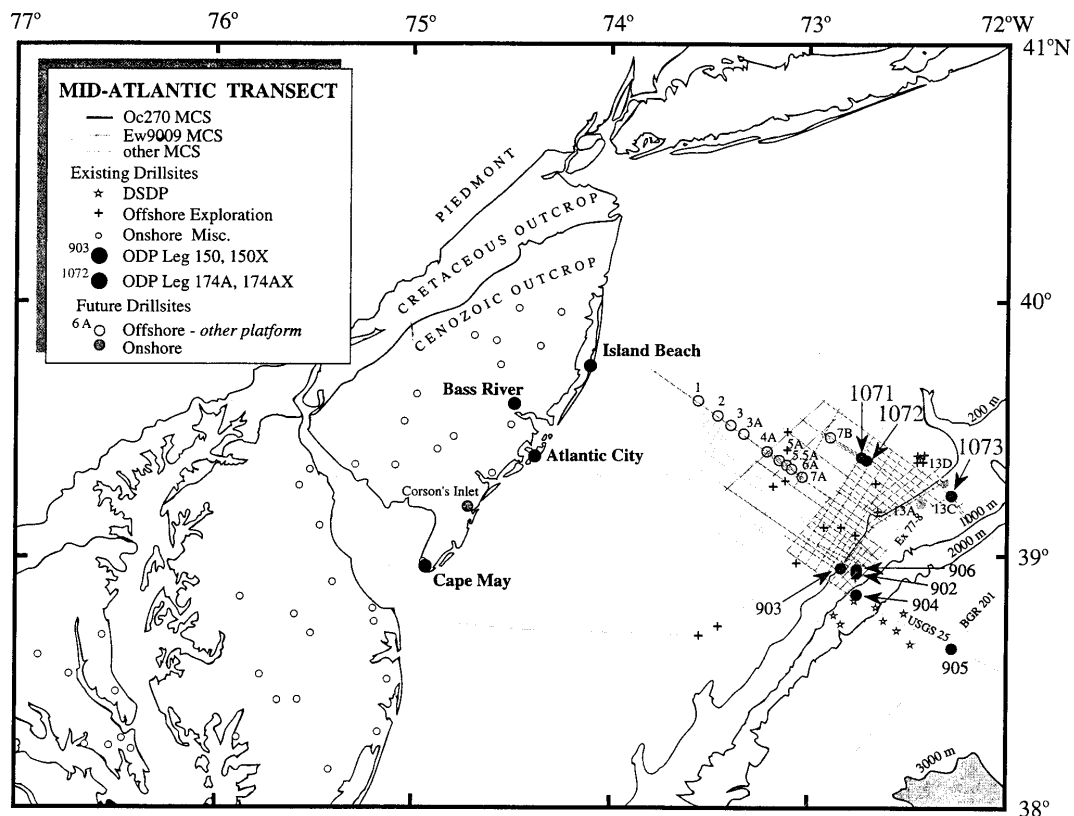


Figure 1. UTIG and L-DEO MCS data coverage (bold: those collected for ONR in 1995) and recent, ongoing, and planned drilling activity on the New Jersey margin.

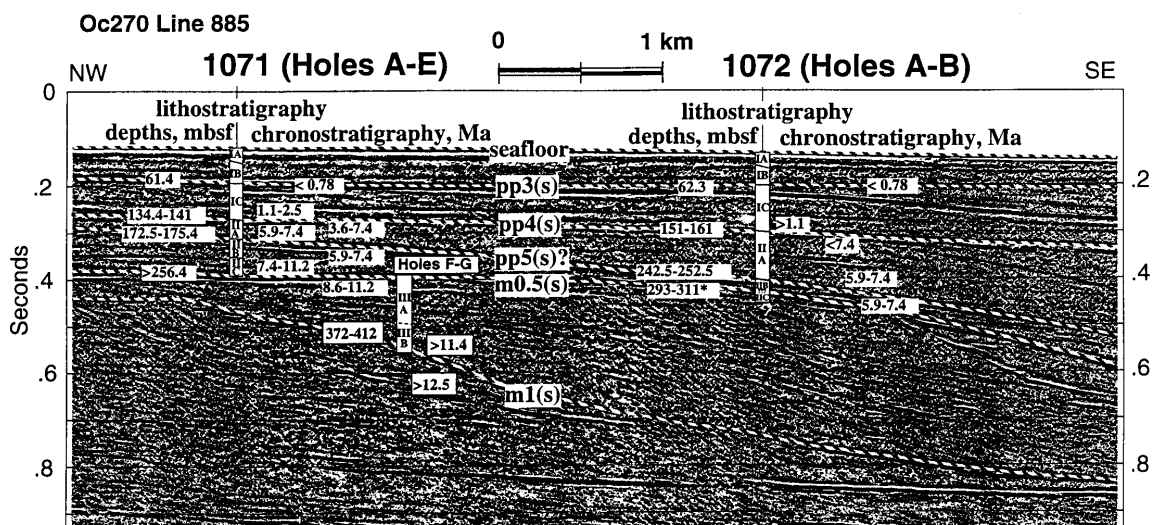


Figure 2. One of the high-resolution MCS profiles collected in 1995 for ONR, running through the ODP Leg 174A shelf sites. Sequence boundaries, their names, and estimated ages (in Ma) are shown (see Austin et al. , 1997).